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ON THE VARIATION IN THE POSITION OF THE STOLON IN AUTOLYTUS.

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IN the investigation of the variation in the position of the region of stolonization in bud-forming syllidians, observations were made upon four of the most abundant forms occurring along the Atlantic coast.

Three of these forms — *Autolytus cornutus*, *Autolytus varians*, and *Proceraea ornata* — may be found in abundance at Woods Holl in the summer months, during which time also the phenomenon of budding is most active. The fourth, *Proceraea tardigrada*, occurs in almost equal abundance at Beaufort, N. C. Of these *A. cornutus*, *P. ornata*, and *P. tardigrada* are solitary stolon-bearing, and invariably cast off the first stolon before a trace of a second stolon appears, while *A. varians* belongs to the chain-forming variety and may bear as many as eight stolons in various stages of development attached to the adult individual or so-called parent stock.

The greatest number of variations were observed in the chain-bearing form *A. varians*. The range in the position of the chain stolon in this species is from segment 19 to 58. The largest percentage of individuals were found to bear the chain on or between segments 30 and 38; a smaller percentage on or between segments 39 and 48, and an equal number between segments 25 and 29; fewer between segments 19 and 24, and a very few between segments 50 and 58.

In 155 individuals examined the following results were tabulated. (The upper numerals indicate the number of the segment to which the chain of stolons is attached; the lower, the number of individuals.)

A	{	Seg.	30	31	32	33	34	35	36	37	38
		Ind.	16	5	19	4	20	10	5	14	13

B	{ Seg.	25	26	29	39	40	41	45	48
	{ Ind.	5	4	9	9	6	4	2	3
C	{ Seg.	19	21	24	52	58			
	{ Ind.	1	1	2	2	1			

From this it will be noted that the position of the chain occurs most frequently on some segment in Table *A*, varying between segments 30 and 38, with a decided preponderance in favor of segments 34, 32, and 30, respectively. In other words, the greatest number of individuals have parent stocks of medium length, with from 30 to 38 segments; and the position of the chain on parent stocks of fewer or more numerous segments than this range occurs less frequently as the number of segments becomes less or greater.

Within the range in which the chain has been found to occur most frequently, it will also be noticed that several segments (31, 33, 36) bear the chain much less often than others, so that the chain-bearing phenomenon would appear to be confined more particularly to certain ones of the segments in this range (30, 32, 34, 37, 38).

In observing the sex of the individuals tabulated, it was noted that by far the greater majority of the specimens with the chain attached to the thirtieth segment or anterior thereto bore female stolons, while those with a great number of segments invariably bore male stolons. In this lot of specimens examined no individuals with female stolons were found with a parent stock of more than 41 segments, while those of 19, 21, and 24 segments all bore female stolons. On the other hand, those of 45 and more segments all bore male chains. Bearing in mind that the first stolon of the series in the chain is formed by the separation of a number of segments from the posterior part of the parent stock, this condition might possibly be due to the fact that the female stolons always consist of a far greater number of segments than do the male, and hence in the process of forming the first stolon leave a more reduced parent stock; while in the process of forming the first male stolon fewer segments would be required, and hence a longer parent stock left back.

In *P. ornata* and *P. tardigrada* variations in the position of

the stolon are of comparatively infrequent occurrence. The position of the stolon is very constantly on the thirteenth segment. In more than 200 specimens of *P. ornata* examined, not more than nine were found in which the stolon was attached to any other than the thirteenth segment; of these, six were found to bear the stolon on the fourteenth segment, while in three it was borne on the twelfth segment. In a single instance I have found the stolon as far forward as the eleventh segment. In all cases the variation was among individuals which bore male stolons.

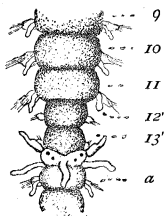
P. tardigrada shows even less variation than *P. ornata*. In 55 individuals examined, not a single case of variation was observed. Out of 110 individuals examined, Andrews (*Proc. U. S. Nat. Mus.*, Vol. XIV) obtained three specimens with the bud attached to the fourteenth segment.

Variations in the position of the stolon in the two species of *Proceraea* would accordingly be confined almost exclusively to occurrences of the position of the stolon either immediately anterior or posterior to a fixed segment, the posterior position being the most frequent form of variation.

In *A. cornutus* variations in the position of the bud are of still less frequent occurrence. Out of 178 specimens examined at a time when the forms were most abundant, not a single case of variation was observed. I have, however, found specimens in which the stolon was attached to the twelfth segment, but, as compared with *Proceraea*, such occurrences are very rare.

A further proof of the more constant occurrence of the bud on the thirteenth segment in this species is the fact that in individuals in which mutilation or severance of segments anterior to the region of budding has occurred, in the subsequent regeneration of new segments, the bud will not, as I have observed in *Proceraea*, develop its head from the tissues of the most anterior regenerated segment, but will first of all regenerate the lost segments of the parent stock, and following these produce the bud. The accompanying figure represents a specimen in which all the segments of the parent stock posterior to the eleventh were amputated and have been replaced by a series of new segments. The bud, instead of taking its origin in the

plane of new tissue formation, *i.e.*, on the twelfth segment, has followed the law of budding in this species and developed its head from the tissues of the fourteenth segment, and thus added two segments to the parent stock. The addition of new tissue to the parent stock, after amputation of one or two of its posterior segments, I have never been able to find in *Proceræa*, and so far as I have been able to carry my observations, I am convinced that such a condition does not take place, but that



9, 10, 11, old segments of parent stock; 12', 13', regenerated segments of parent stock; a, stolon with developing head.

instead, wherever new segments are formed following amputation, the head takes its origin from the tissues of the first new segment formed.

From these observations it would appear, therefore, that by far the greatest variation occurs in the chain-bearing form of *Autolytus*. The great range in the position of the chain, and hence the amount of variation, is modified by a condition to which I have already referred in a previous paper (*Journal of Morphology*, Vol. XVI, No. 2). I have there shown that

in this species, in the region in which new segments are being formed (region of proliferation), not all the newly formed segments are pushed back for the formation of new stolons, but that occasionally some of these segments become segments of the parent stock, and thus considerably increase its length. In this way I endeavor to account for the great length (40–58 segments) of the parent stock in the stouter and more developed specimens—a length which I have shown does not exist in the younger and more slender forms. This being the case, the true range of variation would have to be sought in such specimens only which are in the act of forming a first stolon by the separation of the posterior segments of the parent stock. Of such individuals I have found specimens sufficient to give a range from segment 19 to as high as segment 38. Thus while variation here, as identical with the mode of variation in the species investigated, does not present so wide a range as indicated in the tabulation, nevertheless it shows a far greater range and is of much more frequent occurrence in chain-forming

than in the solitary stolon forms. In marked contrast to the variations in *A. varians* is the constancy in the position of the bud in *A. cornutus*, where new segments even are formed for the maintenance of a fixed position of budding.

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